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Tax fairness in eleventh century England

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TAX FAIRNESS IN ELEVENTH CENTURY ENGLAND

Abstract: Alongside the Roman census from Augustus' time and the ecclesiastical surveys or polyptychs of the 8th and 9th century Carolingian kingdoms, the Domesday Survey of 1086 occupies a most significant place in accounting history. Domesday Book, the outcome of the Survey, lists the incomes, tax assessments, wealth and resources of most estates in England and was used as a working accounting document by the monarch and public officials to raise taxes, distribute resources and consolidate power. Although the Domesday document itself survives, many details of its construction and use have been lost in the mists of time. This paper describes research to discover how taxes were levied and which estates and tenants received favorable treatment.

INTRODUCTION

In the accounting history literature, Godfrey and Hooper [1996] have convincingly argued that aspects of Domesday Book, the results of a survey commissioned by William the Conqueror, illustrate the concepts of accountability, decision-making and control.

Domesday Book served many purposes. It documented feudal tenancy arrangements and was a land register being used extensively to resolve land disputes in the courts. Indeed, the book's name derives from this use. The manuscript refers to itself as the "Discriptio", and it was only after Williams' death referred to as "Domesday Book", the book of last judgment, for

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in land disputes there was no appeal beyond its pages — land rights could be traced to Domesday Book but no earlier.

As well as being a legal document, the book had a financial and decision-making purpose. It lists the incomes, tax assessments, wealth and resources of most estates in England and was used as a working accounting document by the monarch and public officials to raise taxes, distribute resources and consolidate power. As Godfrey and Hooper [1996, p. 51] state "By providing a valuation and audit of the resources of the feudal tenants-in-chief in 1086, Domesday enabled William and his successors to optimize both their wealth, through fiscal policy and efficient use of the country's resources, and their power within the feudal structure of medieval England. For the English monarchy of the period, Domesday served both accountability and decision-making needs".

Together with other ancient surveys that assisted financial accountability, the Roman tax census during the four centuries following Emperor Augustus and the ecclesiastical polyptychs of the 8th and 9th centuries which were used for tax and accounting purposes, the Domesday Survey occupies a landmark position in accounting history. Godfrey and Hooper [1996, p. 39] argue, "Domesday represents a partial extension of and evolution from what might be broadly termed public sector accounting as practiced in both the Roman and Carolingian periods".

Although the Domesday document itself survives, many details of its construction and use have been lost. This paper describes research to discover how the taxes were levied and which estates and tenants received favorable treatment. Domesday Book records the tax assessments for the geld, a non-feudal tax levied by the king. The tax assessments are reported in hides and fiscal acres and are often referred to as the hidage system. In this paper, frontier methods are used to investigate who, and which estates, received beneficial hidation, and what factors were associated with favorable tax assessments.

DOMESDAY ENGLAND AND THE DOMESDAY SURVEY

The Domesday Survey was carried out 20 years after William invaded England from France. By 1086, Norman rule had been largely consolidated, although only after rebellion and civil dissent had been harshly put down. The Conquest was achieved by an elite. It did not result in a mass movement of people, and, although the Normans brought new institutions and practices, these were superimposed on the existing order. Most of the

Anglo-Saxon aristocracy were eliminated, the lands of over 4,000 English lords passing to less than 200 Norman barons, with much of the land held by just a handful of magnates.

William I ruled forcibly through the Great Council. England was divided into shires, or counties, which were subdivided into hundreds. There was a sophisticated and long established shire administration. The sheriff was the king's agent in the county, royal orders could be transmitted through the county and hundred courts, and an effective taxation collection system was in place.

England was a feudal state. All land belonged to the king. He appointed tenants-in-chief, both lay and ecclesiastical, who usually held land in return for providing a quota of fully equipped knights. The tenants-in-chief might then grant the land to sub-tenants in return for rents or services, or work the estate themselves through a bailiff.

Manorialism was a pervasive influence, although it existed in most parts of England in a modified form. On the manor the peasants worked the lord's demesne in return for protection, housing, and the use of plots of land to cultivate their own crops. They were tied to the lord and the manor and provided a resident workforce. The demesne was also worked by slaves who were fed and housed by the lord.

Although Domesday Book records 112 boroughs, agriculture was the predominant economic activity, with stock rearing of greater importance in the south-west and arable faming more important in the east and midlands.

The Domesday Survey was commissioned on Christmas day, 1085, and it is generally thought that work on Domesday Book was terminated on the death of William in September 1087. The task was facilitated by the availability of Anglo-Saxon hidage lists. The counties of England were grouped into (probably) seven circuits. Each circuit was visited by a team of commissioners, bishops, lawyers and lay barons who had no material interests in the area. The commissioners were responsible for circulating a list of questions to land holders, for subjecting the responses to a review in the county court by the hundred juries, often consisting of half Englishmen and half Frenchmen, and for supervising the compilation of county and circuit returns. The circuit returns were then sent to the Exchequer in Winchester where they were summarized, edited and compiled into Great Domesday Book.

Unlike modern surveys, individual questionnaire responses were not treated confidentially but became public knowledge,

being verified in the courts by landholders with local knowledge. In such circumstances, the opportunities for giving false or misleading evidence were limited.

Domesday Book consists of two volumes, Great (or Exchequer) Domesday and Little Domesday. Little Domesday is a detailed original survey return of circuit VII, Essex, Norfolk and Suffolk. Great Domesday is a summarized version of the other circuit returns sent to the King's treasury in Winchester. (It is thought that the death of William occurred before Essex and East Anglia could be included in Great Domesday). The two volumes contain information on the net incomes (referred to as the annual values), tax assessments and resources of most manors in England in 1086, some information for 1066, and sometimes also for an intermediate year. The information was used to revise tax assessments and document the feudal structure, "who held what, and owed what, to whom".[1]

The study described in this paper is based on data relating to 574 lay estates in the county of Essex in 1086. Essex was chosen because more detailed data are available on the counties described in Little Domesday, and the manorial entries for Essex are easier to interpret than those of Norfolk and Suffolk.[2]

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[1] Further background information on Domesday England is contained in McDonald and Snooks [1986, Chs. 1 and 2; 1985a, 1985b, 1987a and 1987b] and McDonald [1998]. For more comprehensive accounts of the history of the period see Brown [1984], Clanchy [1983], Loyn [1962, 1965, 1983], Stenton [1943, 1951]. Other useful references includes Ballard [1906], Darby [1952], [1977], Galbraith [1961], Hollister [1965], Lennard [1959], Maitland [1897], Miller and Hatcher [1978], Postan [1966, 1972], Round [1895, 1903], the articles in Williams [1987] and references cited in McDonald and Snooks [1986]. The Survey is discussed in McDonald and Snooks [1986, sec. 2.2], the references cited there, and the articles in Williams [1987]. The Domesday and modern surveys are compared in McDonald and Snooks [1985c].

[2] The data file was compiled by Eva Aker under the direction of the author with the aid of a Flinders University research grant. The file was compiled directly from Domesday Book entries in the Victoria County History of Essex which were checked against a facsimile of the Latin transcript and an English translation in the so-called Phillimore edition [Morris, 1975]. A general rule of thumb was developed that only entries for which (1) net income (annual value) is positive, (2) either ploughteams or livestock entries are positive (or both), and (3) there is a positive entry for at least one labour variable, were retained for analysis. In addition, seven other entries were deleted either because they were implausible or incomplete, and three others because no tax assessment was recorded. Further details are given in McDonald [1998].

EARLIER STUDIES OF THE GELD

The Domesday tax assessments relate to a non-feudal tax, the geld, thought to be levied annually by the end of William's reign. The tax can be traced back to the danegeld, which was introduced by King Ethelred in 911 to provide finance to bribe or fight the Danes. Originally the geld was a land tax assessed at so much per hide. A hide was traditionally the acreage needed to support a man and his family, conventionally 120 acres, but in practice variable from place to place depending on the fertility of the land. Oldroyd [1997] describes the role of hidage lists and Geld Rolls in public accounting during the Anglo-Saxon period and their significance for accounting history. By Norman times it is thought that, although it retained the nomenclature of a land tax, the geld was no longer solely a tax on land. In 1086 it was one of a number of public revenue sources and probably contributed about a quarter of the total public purse. The geld was a significant impost on landholders, the rate struck in 1083-4 of six shillings to the hide, implies the tax amounted to about 15 percent of the annual value of the average Essex lay manor.[3]

Domesday scholars have written extensively about the tax assessments. Much of the literature has been influenced by Round [1895], who considered the assessments to be "artificial", in the sense that they were imposed from above via the county and hundred with little or no consideration of the capacity of an individual estate to pay the tax. Round's view was largely based on a somewhat unsystematic and subjective review of the distribution of the assessments across estates, vills and the hundreds of counties.

In [1985a] and [1986, Ch. 4], Snooks and I argued that, contrary to Round's hypothesis, the tax assessments were based on a capacity to pay principle, subject to some politically expedient tax concessions. Similar tax systems operate in most modern societies and reflect an attempt to collect revenue in a politically acceptable way.

There is empirical support for our hypothesis. Using regression methods, we showed, for example, that for Essex lay estates about 65 percent of variation in the tax assessments could be attributed to variations in manorial annual values (which measure the net income accruing to the lord) or manorial resources, two alternative ways of measuring capacity to

[3] Further information on the geld and related material are contained in McDonald and Snooks [1986, Ch.4].

pay. Similar results were obtained for other counties. Capacity to pay explains from 64 to 89 percent of variation in individual estate assessment data for the counties of Buckinghamshire, Cambridgeshire, Essex and Wiltshire, and from 72 to 81 percent for aggregate data for 29 counties [See McDonald and Snooks 1987a].

Although capacity to pay seems to explain most variation in tax assessments, some variation remains. Who was treated favorably? Which estates received a beneficial hidation? And what factors were associated with beneficial hidation? Clearly, a first step in addressing these issues is to develop a measure of beneficial hidation.

A simple and appealing measure is based on the idea that an estate has received beneficial hidation if it has a lower tax assessment than another estate with the same or lower annual value (annual value or net income being a measure of capacity to pay). More formally, the beneficial hidation index (BHI) for estate *i*, is defined as the ratio of the maximum tax assessment of all estates with the same or a lower annual value than estate *i*, to the actual tax assessment of estate *i*. A BHI value of one corresponds to no beneficial hidation, and a value greater than one to some beneficial hidation.

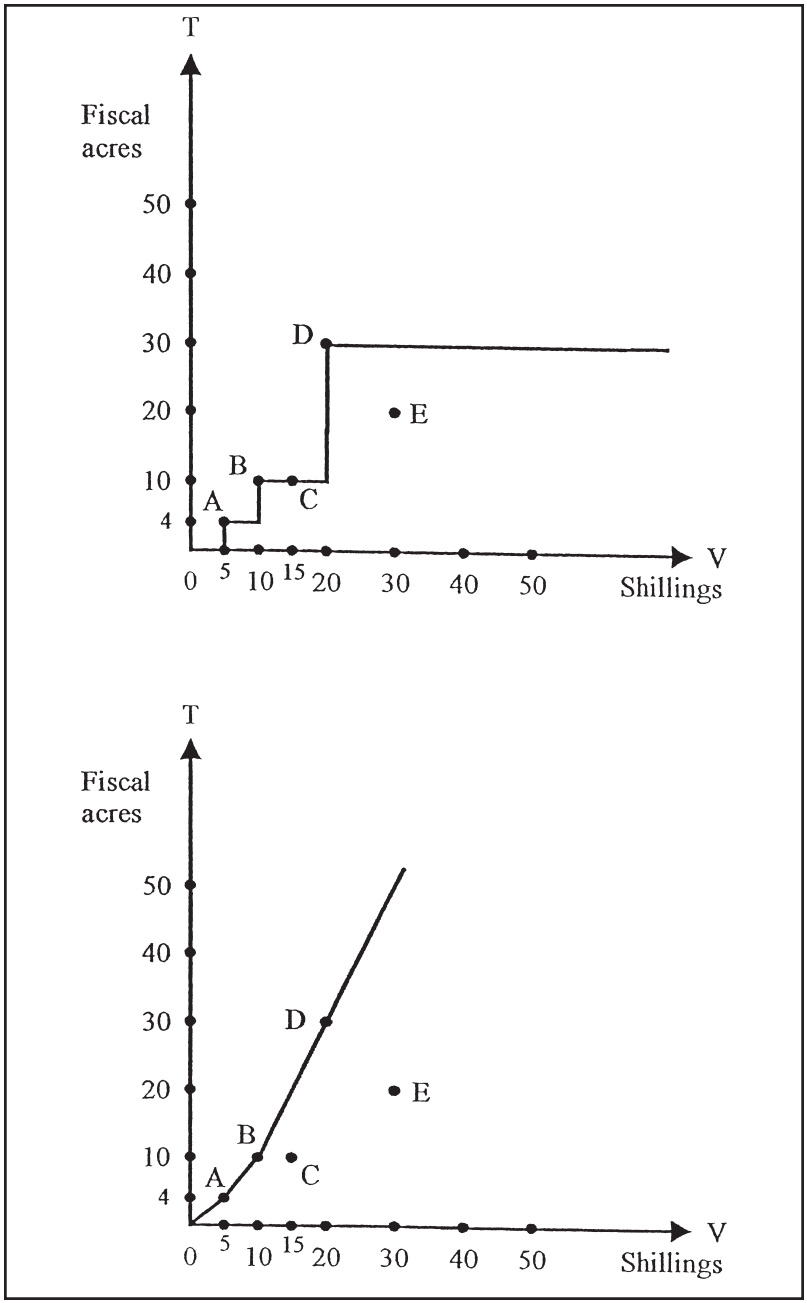
JUSTIFICATION OF THE BHI

Some insight into the plausibility of the BHI (just defined) can be obtained by employing the frontier methodology (sometimes used in production studies, see, for example, Lewin and Lovell, 1990). In Figure 1, A, B, C, D, and E indicate the tax assessments and annual values of five (fictitious) estates. (Estate A, for example, has an annual value of 5 shillings and tax assessment of 4 fiscal acres). To calculate the BHI for an estate, the maximum tax assessment for the estate's annual value is required. The annual values of the five estates are 5, 10, 15, 20 and 30 shillings, and the maximum assessment for estates with equal or lower assessments 4, 10, 10, 30 and 30 fiscal acres, respectively. The maximum assessment values for different annual values can be thought of as describing a "tax frontier".

The frontier that generates the BHI is illustrated in the upper diagram of Figure 1. It consists of the "steps", 0 to the point vertically below A, that point to A, the horizontal line from A to the point vertically below B, and so on. Estate BHIs are the ratio of maximum to the actual tax assessments. For estate E, the BHI=1.5, all other estates have a BHI=1. This frontier would be appropriate if the tax regime was one of constant tax assessment

FIGURE 1

Alternative Tax Frontiers



over annual value intervals (with, for example, estates with an annual value of 5 shillings and less than 10 shilling paying 4 fiscal acres; those with an annual value of 10 and less than 20 shillings, 10 fiscal acres, and so on), with some beneficial hidation.

Other tax frontiers and beneficial hidation indexes are plausible. For example, if the underlying tax regime consisted of multiple constant positive tax rate schedules (with, for example, estates with an annual value of 5 shillings and less than 10 shillings paying at one tax rate, those with an annual value of 10 and less than 20 shillings at a different rate, and so on), with some beneficial hidation, then the frontier is generated by starting at 0 and connecting points representing estates by line segments, so long as the slope of the segment is positive. This frontier is drawn in the lower diagram of Figure 1. 0 is connected to A, and A to B, because the line segments have positive slopes; but B is not connected to C and D not connected to E, because the slopes of the lines would not be positive (implying zero or negative marginal tax rates). Using this frontier, estates A, B and D have beneficial hidation indexes of one, the index for C is two, and for E, two and a half.

Unfortunately we do not know in detail how the Domesday tax assessments were formulated, so we do not know which is the most appropriate frontier, and hence beneficial hidation index.

It is reasonable to ask if it is possible, using empirical methods, to determine the "true" frontier. For example, is the true frontier the frontier that gives the closest fit to the data? Unfortunately, this may not be so. Casual inspection of Figure 1 indicates that the frontier in the upper diagram must always fit the data better than the frontier in the lower diagram (in the sense that the distances of the data points from the frontier cannot be greater and will sometimes be smaller), whether or not it is the true frontier (that is, whether or not the true tax regime is essentially one of constant tax assessment over annual value intervals).

In practice, if there are a reasonable number of observations, well-distributed over the annual values, frontiers and indexes will be similar. The chosen frontier measures beneficial hidation more conservatively (in the sense that an estate's index will tend to be smaller when measured against it) than most others. A major advantage in using it is that it can easily be calculated using linear programming methods [see, for example, McDonald, 1998, pp. 41-56].

BENEFICIAL HIDATION IN ESSEX IN 1086

When the frontier was constructed from the tax and annual value data for the 574 Essex lay estates in 1086, 18 estates lay on the tax frontier and so had a BHI=1.[4] Figure 2 gives the frontier, the numbers on the frontier being the identification codes of the estates that form the frontier.

FIGURE 2

Tax Assessment Frontier. Essex Lay Estates, 1086

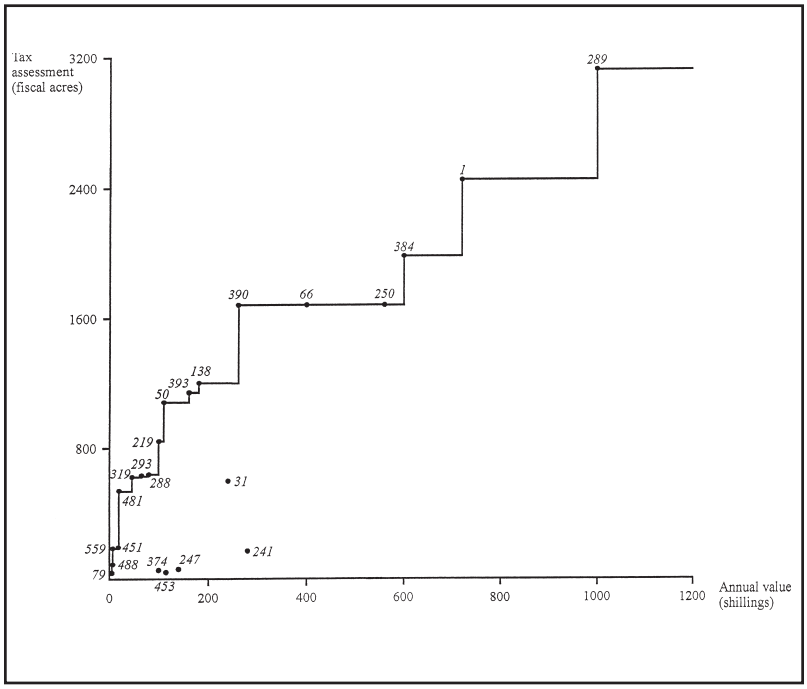


Table 1 gives the names of the estates and other information about them. For example, 1 refers to Fobbing an estate with an annual value of 720 shillings and a tax assessment of 2445.5 fiscal acres. All other estates are represented by points below the frontier. A few are located by a dot and their identification code, information about these estates being contained in Table 2.

[4] For any annual value, the frontier indicates the maximum tax assessment of all estates with that or a lower annual value, and an estate's BHI is the ratio of the maximum assessment to the actual assessment of the estate.

TABLE 1

Characteristics of Estates with a Beneficial Hidation Index (BHI) of one. Essex Lay Estates, 1086

Estate		BHI	Tax assessment	Frontier assessment	Annual value	Tenant-in-chief	Tenancy	Hundred
1	Fobbing	1	2445.5	2445.5	720	Count Eustace	Demesne	Barstable
50	Tolleshunt Guines	1	1081	1081	110	Count Eustace	1 sub-tenant	Thurstable
66	Elmdon	1	1680	1680	400	Count Eustace	1 sub-tenant	Uttlesford
79	Lt. Bentley	1	42.5	42.5	3	Count Alan	1 sub-tenant	Tendring
138	Wickford	1	1200	1200	180	Suen of Essex	Demesne	Barstable
219	Purleigh	1	840	840	100	Hugh de Montfort	Demesne	Dengie
250	Woodham Ferrers	1	1680	1680	560	Henry de Ferrariis	Demesne	Chelmsford
288	Stow Maries	1	637	637	65	Geoffrey de Magna Villa	1 sub-tenant	Dengie
289	Saffron Walden	1	3120	3120	1000	Geoffrey de Magna Villa	Demesne	Uttlesford
293	Weneswic	1	640	640	80	Geoffrey de Magna Villa	1 sub-tenant	Dengie
319	Wivenhoe	1	625	625	46	Robert Greno	1 sub-tenant	Lexden
384	Debden	1	1980	1980	600	Ranulf Peverel	Demesne	Uttlesford
390	Down	1	1680	1680	260	Ranulf Peverel	demesne	Dengie
393	Stangate	1	1140	1140	160	Ranulf Peverel	1 sub-tenant	Dengie
451	Ardleigh	1	195	195	17.67	Ranulf brother of Ilger	1 sub-tenant	Tendring
481	Leyton	1	540	540	20	Robert son of Corbutio	demesne	Becontree
488	Paglesham	1	90	90	5	Robert son of Corbutio	1 sub-tenant	Rochford
559	East Donyland	1	188	188	7	Ilbodo	demesne	Lexden

Note: Tax assessments are measured in fiscal acres and annual values in shillings.

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TABLE 2

Characteristics of Selected Estates that Received Beneficial Hidation. Essex Lay Estates, 1086

	Estate	BHI	Tax assessment	Frontier assessment	Annual value	Tenant-in-chief	Tenancy	Hundred
31	Boxted	2.00	600	1200	240	Count Eustace	demesne	Lexden
241	Stambrn/Toppesfld	9.88	170	1680	280	Hamo dapifer	demesne	Hinckford
374	Fairsted	15.27	55	840	100	Ranulf Peverel	1 sub-tenant	Witham
247	Tiltey	18.02	60	1081	140	Henry de Ferrariis	demesne	Dunmow
115	How Hall	19.23	43.6	625	50	Richard son of C. Gilbert	1 sub-tenant	Hinckford
453	Stevington End	25.44	42.5	1081	115	Tithel the Breton	demesne	Freshwell H-H
500	Sibil Hedingham	25.60	25	640	80	Roger Bigot	1 sub-tenant	Hinckford
28	Toppesfield	36.00	15	540	20	Count Eustace	1 sub-tenant	Hinckford
207	Radwinter	36.00	15	540	30	Eudo dapifer	1 sub-tenant	Freshwell H-H
555	Tendring	36.00	15	540	20	Moduin	demesne	Tendring
395	Prested	37.60	5	188	12	Ranulf Peverel	1 sub-tenant	Lexden
195	Broxted	71.11	9	640	80	Eudo dapifer	1 sub-tenant	Dunmow

Note: Tax assessments are measured in fiscal acres and annual values in shillings.

Figure 3 exhibits the BHI histogram. Three percent of estates had a BHI=1, about a quarter a BHI less than two, roughly a half an index value less than three, and three quarters a value less than five. Some estates had high BHI values. Seven percent had values of ten or more, with 195 Broxted and largest value of 71.11.

FIGURE 3

Beneficial Hidation Index (BHI) Histogram. Essex Lay Estates, 1086

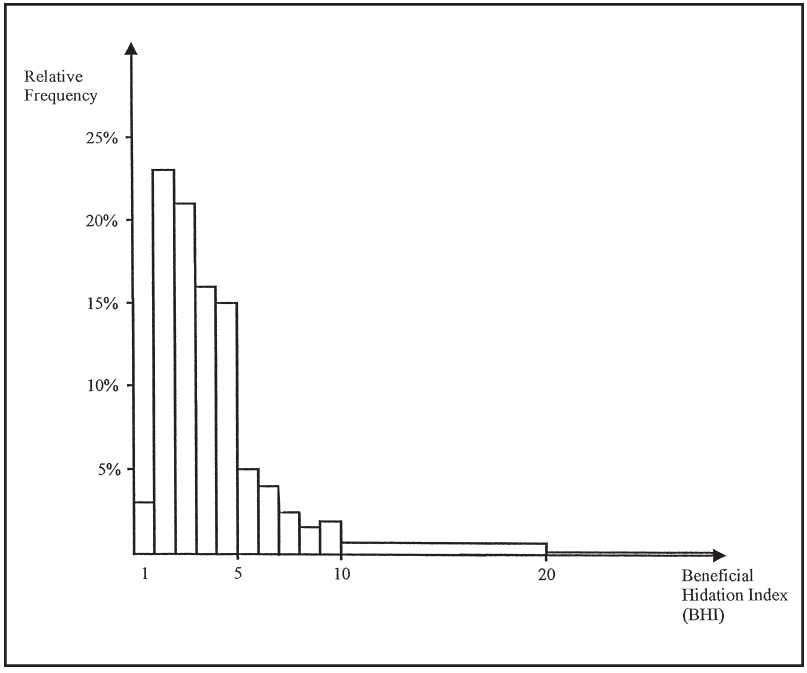


Table 1 provides summary information about the 18 estates lying on the frontier. No obvious patterns are evident for these estates. Some tenants-in-chief were major magnates, such as Count Eustace of Boulogne, Count Alan of Brittany, Suen, Sheriff of Essex and Geoffrey de Magna Villa, Sheriff of Middlesex, but several estates had tenants-in-chief who were less significant lords. In terms of tenancy, nine estates were held in demesne (that is, were worked by the tenant-in-chief) and nine had a single sub-tenant. Five of the frontier estates were in the hundred of Dengie, three in Uttlesford, two in Barstable, Lexden and

Tendring, and one in each of Rochford, Beacontree, Chelmsford and Thurstable. The estates seem to be well-distributed over the hundreds.

Turning to the estates with very high BHIs (greater than 18), from Table 2 it can be seen that they range from 395 Prested with a small annual value of only 12 shillings to a relatively large estate 247 Tiltey with an annual value of 140 shillings (140 shillings exceeds the annual value of more than three quarters of the estates in the sample). Of the nine estates with a BHI greater than 18, most had minor lords as tenants-in-chief, six were sub-tenancies and three held in demesne. Three estates were in Hinckford hundred, two in Dunmow, two in Freshwell half hundred and the others in Tendring and Lexden hundreds.

In footnotes to the Victoria County History entries for Essex [VCH, 1903], Round commented that four of the nine estates with very high BHIs had abnormal or nominal assessments. (These were 195 Broxted, 247 Tiltey, 28 Toppesfield and 500 Sibil Hedingham). He also commented on the low assessments of other estates with smaller BHIs.[5] Round's comments are rather unsystematic. By calculating BHIs for each estate it is possible to identify estates with low or abnormal assessments in a more comprehensive fashion.

STATISTICAL ANALYSIS OF FACTORS AFFECTING BENEFICIAL HIDATION

In the previous section the characteristics of estates with extreme BHI values were examined. Results of more comprehensive analyses of factors associated with beneficial hidation are contained in Tables 3, 4 and 5.

Table 3 lists the mean BHI of estates of the 18 largest tenants-in-chief (those that had more than 10 estates in Essex). Eudo dapifer has the largest mean value (7.87). The deviation of this value from the overall mean (4.35) is 3.52. Notice, however, that the standard deviation of Eudo dapifer's mean BHI is large (3.09). The high mean value is mainly due to the high BHIs of two of Eudo dapifer's estates: 195 Broxted (BHI=71.11) and 207 Radwinter (BHI=36.00). Richard, son of Count Gilbert also has

[5] Examples are the assessments of 374 Fairsted (BHI=15.27) described as "strangely low" [VCH, 1903, footnote 4, p. 527], 571 Gestingthorp (BHI=8.00) also referred to as "strangely low" [footnote 9, p. 564], 241 Stambourne and Toppesfield (BHI=9.88) described as "an almost nominal amount" [footnote 4, p. 502] and 273 High Easter (BHI=3.26) "a very low hidation" [footnote 4, p. 509].

a high mean BHI (7.27), which is significantly greater than the overall mean.

Those who were not leniently treated include Robert, son of Corbutio (mean BHI=2.06), Robert Greno (mean BHI=2.73), Ralf Baignard (mean BHI=2.87), Ranulf, brother of Ilger (mean BHI=2.94) and Hugh de Montfort (mean BHI=2.97).

TABLE 3

Mean BHI of Estates of 18 Largest Tenants-in-chief. Essex Lay Estates, 1086

Tenant in chief	Mean BHI	Standard deviation	Deviation from overall mean	Number of estates in sample
Count Eustace	4.25	0.56	-0.10	71
Suen of Essex	4.19	0.48	-0.16	57
Geoffrey de Magna Villa	3.55	0.31	-0.80	42
Robert Greno	2.73	0.29	-1.62	44
Richard son of Count Gilbert	7.27	0.88	2.92	29
Ranulf Peverel	4.26	1.03	-0.09	37
Ralf Baignard	2.87	0.37	-1.48	29
Eudo dapifer	7.87	3.09	3.52	24
William de Warene	3.93	0.46	-0.42	18
Ranulf brother of Ilger	2.94	0.41	-1.41	17
Hugh de Montfort	2.97	0.47	-1.38	17
Hamo dapifer	4.33	0.66	-0.02	15
Peter de Valognes	4.76	1.31	0.41	14
Aubrey de Ver	4.76	0.82	0.41	16
Robert son of Corbutio	2.06	0.35	-2.29	11
Count Alan	4.50	1.13	0.15	9
Roger de Ramis	5.66	1.17	1.31	12
John son of Waleram	5.34	1.14	0.99	8
Others	4.77	0.51	0.42	104

There is a clear tendency for the tenants-in-chief with the largest number of estates in Essex to have less favorable assessments. 10 of the 12 largest tenants-in-chief have a mean BHI below the overall mean (4.35), and all but one of the remaining six tenants-in-chief a mean above the overall mean. The vast majority of tenants-in-chief fall in the 'other' category. Their mean BHI is also above the overall mean, indicating that they tended to be treated more leniently.

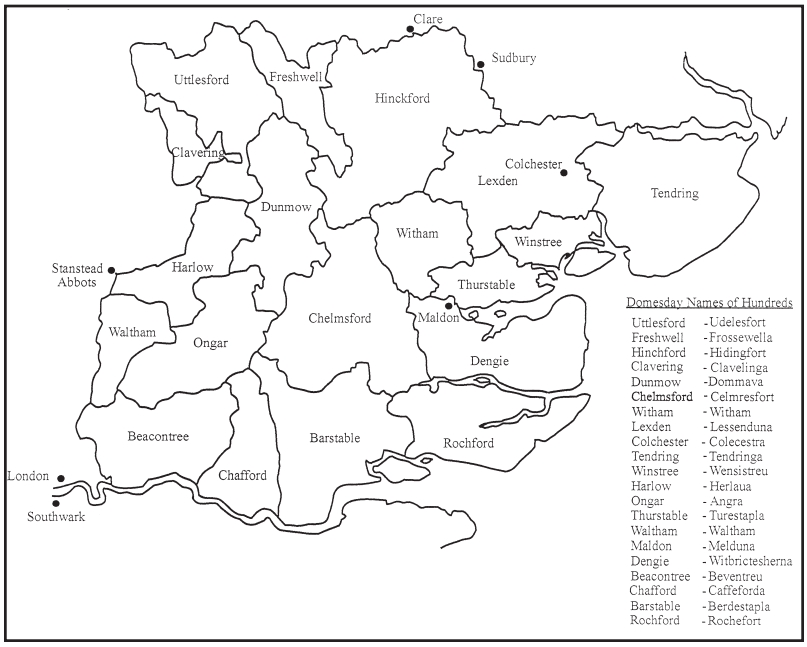
A more objective way of assessing whether, in general, tenants-in-chief were treated equally is to carry out a statistical test using the full sample of observations. A robust statistical test of

the null hypothesis that the mean BHIs for the tenants-in-chief are equal, resulted in rejection of the null at the five and one percent significance levels.[6] The test indicates that who the tenant-in-chief was is a significant factor influencing how estates were taxed, with some, mainly smaller, tenants-in-chief receiving more favorable treatment than others.

Figure 4 is a map indicating the Essex hundred divisions and Table 4 gives a breakdown of mean BHI by hundreds. A statistical test indicates that the BHI varied significantly (at the five and one percent levels) with hundred location.[7] Hundreds

FIGURE 4

Domesday Essex Hundreds



[6] The test was carried out by regressing the BHI on tenant-in-chief dummy variables taking the value 1, if the tenant-in-chief held the estate; 0, otherwise. Since the regression diagnostics indicated heteroskedasticity in the disturbances, White's [1980] heteroskedasticity-consistent test was used. On the null, the test statistic is asymptotically distributed as a F-distribution with 18 and 555 degrees of freedom. The test statistic value was 4.293 which, to five decimal places, has a p-value of zero.

[7] The test was carried out in a similar way to the test for equality of the tenant-in-chief means (using White's method, see previous footnote). The test statistic value (asymptotically F-distributed with 21 and 552 degrees of freedom on the null) was 11.085, which, to five decimal places, gives a p-value of zero.

for which estates received milder assessments included Freshwell half hundred (mean BHI=8.94), Hinckford (mean BHI=7.43), Dunmow (mean BHI=6.60), Lexden (mean BHI=5.57) and Maldon half hundred (mean BHI=5.40). Those less-well treated were Beacontree (mean BHI=1.55), Dengie (mean BHI=2.34), Clavering hundred and half hundred (mean BHI=2.37), Winstree (mean BHI=2.38), Waltham (mean BHI=2.39), Chafford (mean BHI=2.43), Chelmsford (mean BHI=2.52) and Barstable (mean BHI=2.55).

TABLE 4

Mean BHI of Estates by Hundred. Essex Lay Estates, 1086

Tenant in chief	Mean BHI	Standard deviation of mean	Deviation from overall mean	Number of estates in sample
Barstable	2.55	0.21	-1.80	35
Beacontree	1.55	0.10	-2.80	9
Chafford	2.43	0.39	-1.92	12
Chelmsford	2.52	0.14	-1.83	48
Dengie	2.34	0.25	-2.01	41
Dunmow	6.60	1.44	2.25	48
Clavering hundred and half hundred	2.37	0.33	-1.98	10
Freshwell half hundred	8.94	2.18	4.59	17
Harlow	3.61	0.88	-0.74	18
Harlow half hundred	2.97	0.77	-1.38	3
Hinckford	7.43	0.67	3.08	73
Lexden	5.57	1.21	1.22	31
Ongar	5.09	0.51	0.74	34
Rochford	4.10	0.57	-0.25	36
Tendring	3.74	0.74	-0.61	48
Uttlesford	2.90	0.27	-1.45	39
Waltham	2.39	0.80	-1.96	4
Winstree	2.38	0.26	-1.97	15
Witham	4.83	0.75	0.48	26
Maldon half hundred	5.40	3.60	1.05	2
Thunreslau half hundred	3.30	0.72	-1.05	3
Thurstable	2.89	0.36	-1.46	22

The above analysis indicates that all estates were not treated equally, but that tax treatment varied significantly across tenants-in-chief and the hundreds. An obvious question to ask is, if, when we allow for the hundred effect, the tenant-in-chief effect

is still significant, and, if, when we allow for the tenant-in-chief effect the hundred effect remains significant. Extending the argument we could examine the relationship between the BHI and all factors that might plausibly be expected to affect it and for which information is available at the estate level. Multiple regression could then be used to estimate the relationship and test whether one factor (for example, who the tenant-in-chief was) significantly affects the index when all other factors are controlled for.

This approach was implemented. As well as who the tenant-in-chief was and hundred location, information is available, estate by estate, on whether the estate was close to an urban center, the size of the estate, the kind of agriculture practiced and the tenure arrangement on the estate, all factors that could affect an estate's tax assessment. Table 5 exhibits the main results of a regression of the BHI on variables measuring these characteristics.[8] Details of the implementation of the hidage system are now largely unknown, so the regression will provide empirical evidence as to whether particular groups or activities received special treatment, and, given these special considerations, whether the assessments were evenly distributed over the county.

The results show that the tenant-in-chief and hundred effects remain significant when other factors are allowed to vary in the multiple regression. Whether the estate was close to Maldon or Colchester was also a significant factor. The BHI for

[8] Tenant-in-chief was indicated by 18 dummy variables (the ith, i=1 . . . 18, taking the value 1, if the ith largest tenant-in-chief held the estate; 0, otherwise; the intercept measuring the effect when none of the 18 largest tenants-in-chief held the estate), and the hundred location by 21 dummies (with the intercept measuring the effect of location in Thurstable hundred). Colchester and Maldon were the main towns in Essex. The effect of proximity to an urban centre was measured by a dummy variable, taking the value 1, if the estate was in an approximate six mile radius of Colchester or Maldon (allowing for topology); 0, otherwise. Size was measured by the single best indicator of the economic size of an estate, the estate's annual value. An index of whether production was mainly arable or grazing is given by the grazing/arable ratio, defined as livestock less cattle and beasts (which were required for ploughing) divided by the number of ploughteams on the estate. (Livestock less cattle and beasts is a weighted average of swine, sheep and goats with prices as weights. Three estates had no ploughteams. For them, the ratio was set at 2000, the largest ratio value for estates with some ploughteams being 1376). Finally, tenure was measured by dummy variable taking the value 1, if the estate was held in demesne; 0, otherwise. Test statistics are heteroskedasticity-consistent tests statistics obtained by White's [1980] method.

TABLE 5

Regression of BHI on Estate Characteristics. Essex Lay Estates, 1086

	Test statistic	Distribution on null	P-value
Tenant-in-chief effect	1.857*	F(18,530)	.017
Hundred effect	5.164**	F(21,530)	.000
Urban centre effect	-3.1**	*t*(530)	.002
Size (annual value) effect	-4.0**	*t*(530)	.000
Kind of agriculture (grazing/ arable ratio) effect	-1.1	*t*(530)	.255
Tenure effect	-2.2*	*t*(530)	.028

Note: The tests are heteroskedasticity-consistent tests [see White, 1980].
* indicates significant at the five percent level and
** significant at the one percent level. R^2=.17

estates close to these towns was, on average, 1.73 lower than for other estates. Economic size (measured by annual value) of the estate also significantly affected the index value. A large estate (with an annual value of 320 shillings) had an average index value 1.80 less than a small estate (with an annual value of 20 shillings). Whether or not an estate was held in demesne was a significant factor at the five percent level. Estates held in demesne, on average, had a BHI 0.91 less than those that were sub or mesne-tenancies. The variable measuring the mix of arable and grazing agriculture on an estate was not a significant correlate.

CONCLUSION

The paper has presented the results of an investigation into the incidence of favorable tax assessment (hidation) in Domesday Essex. Frontier methods were used to derive a measure of beneficial hidation, and estates with favorable and unfavorable assessments identified. Tenants-in-chief and local areas (hundreds) of the county with lenient assessments were discovered, and regression methods used to assess the significance of the association of characteristics of estates and beneficial hidation. Factors significantly associated with beneficial hidation were the tenant-in-chief holding the estate (hidation tended to be less beneficial for the tenants-in-chief holding a large number of estates in Essex), the hundred location,

proximity to an urban center (estates remote from the urban centers being more favorably treated), economic size of the estate (larger estates being less favorably treated) and tenure (estates held as sub-tenancies having more lenient assessments). The kind of farming undertaken (arable or grazing) was not a significant factor.

The details of the levying of the geld in 1086 are largely lost in time, but the evidence clearly indicates that the manorial tax assessments were based on a capacity to pay principle (as measured by the manor's annual value), and the analysis of estate BHIs shows that other factors also had a significant influence.

In most tax systems, certain groups or activities receive concessions and the administrative process induces unevenness in the assessments. The BHI analysis indicates that, allowing for the capacity of an estate to meet the tax, some estates were indeed favored above others. The results show that some tenants-in-chief were treated more leniently than others, and, interestingly, it tended to be the tenants-in-chief holding fewer rather than more estates in the county. At the margin, the assessment system may have tended to favor the less wealthy because, it was also found that smaller estates and those held by sub-tenants received lower assessments, and urban estates (often held by the wealthy), higher assessments.

The fact that there was a significant hundred assessment differential, suggests that administrative factors affected the hidage system. This could have been because the assessments were made at different dates or with (slightly) more rigor in some hundreds than others. As for concessions being given when particular activities were undertaken, the regression provides no evidence of this. In particular, the tax system did not favor arable activity over animal husbandry or vice versa.

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